# Appendix K

## Bat Assessment Survey Reports

# *Survey of Bats*

# *Northwest Ohio Wind Energy Project*

## *Paulding County, Ohio*

July 2010

Submitted to

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# *Introduction*

A wind energy project is planned for Paulding County in Northwest Ohio. The Ohio Department of Natural Resources has developed a set of protocols to determine potential impacts to bats associated with new wind energy projects[1]. Wind energy providers are encouraged to adopt these procedures and initiate coordination with Ohio Department of Natural Resources at the earliest possible date.

The United States Fish and Wildlife Service has previously reviewed habitat data for the proposed facility and has recommended mist-netting surveys to more fully understand the use of this area by bats, especially the federally endangered Indiana bat. The proposed facility abuts a 5-mile radius of a historical record for Indiana bat. The United States Fish and Wildlife Service requested two sites be established to determine the status of Indiana bat from the project area. One site/each was requested for Prairie and Blue Creeks.

This document details the results of an Indiana bat survey for the Northwest Ohio Wind energy project.

## *Bats of Ohio*

Eleven species of bats are known to inhabit the State of Ohio. The Indiana bat is both a state and federally listed endangered species. In addition, Rafinesque big-eared bat and small footed bat are state protected species. Any of these bats could potentially be present within the confines of the study area.

Big brown bat (*Eptesicus fuscus*)
Little brown bat (*Myotis lucifugus*)
Northern long-eared bat (*Myotis septentrianalis*)
Indiana bat (*Myotis sodalis*)
Tri colored bat (*Perimyotis subflavus)*
Red bat *(Lasiurus borealis)*
Hoary bat (*Lasiurus cinereus*)
Silver haired bat (*Lasionycteris noctivagans)*
Small footed bat (*Myotis leibii*)
Evening bat (Nycticeius humeralis)
Rafinesque big-eared bat (*Corynorhinus rafinesquii*)

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[1] On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio - An Addendum to the Ohio Department of Natural Resource's Voluntary Cooperative Agreement, May 4, 2009.

# *Indiana Bat Natural History Summary*

While all bats may potentially be impacted by wind energy development, special attention is afforded to Indiana bat due to its sensitivity and highly protected class.

The Indiana bat is a migratory hibernator, and caves and abandoned mines are the primary winter habitat or hibernacula. Indiana bat is particularly selective in its choice of hibernacula, occupying only those that have stable winter temperatures.

Following hibernation, female bats of cave dwelling species disperse (March-May) and can potentially be found throughout Ohio. After emerging from winter hibernation, females migrate to summer maternity roosts to rear their young. Indiana bat is highly specific concerning maternity roost selection. Maternity roosts are almost exclusively trees with characteristics that include exfoliating bark or open cavities larger than a fist. *Carya ovata* (shagbark hickory) is commonly cited as the classic maternity roost tree for this species. Furthermore, maternity roosts usually need to be positioned so as to receive sufficient amounts of direct sunlight to provide thermal conditions necessary for the rapid development of young (Humphrey, et al., 1977) (Kurta, et al., 1993). Trees at the edges of streams or in beaver ponds, standing alone in fields or fence-rows, or in forest clearings are usually chosen, as they tend to receive more sunlight than a tree in the middle of a dense woods or forest.

Other species of colonial bats are less selective regarding their choice of summer roost sites. While they all seek the same general environments (high temperatures), some have adapted well to the presence of humans. Big brown and little brown bats are just as likely to utilize the dry, hot environments of attics and barns as they would natural trees. Northern long-eared bat, and tri-colored bat will occasionally make use of these artificial environments as well. Red bat, hoary bat, and silver-haired bat are not known to utilize any artificial roost structure and are limited to the foliage of trees and shrubs where females raise their pups in solitary. Rafinesque's big-eared bat is entirely cave dependant using these habitats in both summer and winter.

Most bats forage over wooded areas and riparian and floodplain forests near small to medium sized streams. Larger bats such as red bat and big brown bat are more likely to forage over larger streams and clearings while smaller species generally prefer the protection offered by foraging under canopy cover. Size and habitat affinity are also somewhat dependant on flight/foraging strategy. Red bat has evolved a body structure and foraging strategy that relies on speed at the expense of maneuverability while smaller bats generally have greater maneuverability but lack the speed of larger species.

Most species of bats are noted to be in decline. Deforestation has been cited as a cause of decline for most species of bats as has the bioaccumulation of pesticides and the accidental or even deliberate destruction of hibernation sites. Tree cutting during the summer brooding season is especially destructive and can impact entire colonies. In order to protect Indiana bats, the U.S. Fish and Wildlife Service (USFWS) restricts the cutting of potential maternity roost trees between April 1 and September 30. The removal of trees outside of this time period can be conducted with minimal impact to the species. If circumstances necessitate the cutting of trees within this restricted period, a mist-netting survey is required to document the status of this species within the area of concern.

In the past three years, a new threat has emerged for all species of bats that are known to hibernate in caves. White nose syndrome (WNS) is a fungus associated with large kills of hibernating bats. The fungus is first noticed around the nose of bats in hibernation and generally is followed by the death of an infected bat. At the present time, it is unknown whether the fungus is the cause of death or merely a secondary symptom of some other disease or condition. White nose syndrome first appeared in caves in Vermont and has spread as far west as Pennsylvania. White nose syndrome is presently unknown from Ohio.

# Methods

## Mist-Netting Techniques

Survey techniques followed Ohio DNR guidelines for wind energy sites. Current guidelines issued by the Ohio Department of Natural Resources and the USFWS indicate that a prevalence of suitable weather must persist throughout the course of the investigation. Strong winds, precipitation, and temperatures below 10 degrees Celsius (50 degrees Fahrenheit) may deter bats from flying and foraging for insects.

Sites were selected during a separate field reconnaissance conducted by representatives of National Wind and Tragus.

At each site, four net sets were constructed. Each net set consisted of a tier of low-visibility nylon mist nets was erected across likely flyways and other areas where bat activity was anticipated or otherwise noted. When possible, nets were erected to sufficient height and width to entirely block off the flight corridor. At least one net set for each site consisted of a series of three nets stacked vertically. Nets were secured to a rope-and-pulley system suspended from telescoping poles (Kunz, 1988). Nets were erected during the twilight hours and monitored every 5-10 minutes for a five-hour period. All mist nets were constructed of 50-denier/2-ply (1.5-inch mesh) nylon.

## Data Collection

Basic biological data were collected from all bats netted, including species identification, ear, tragus, forearm length, gender, age (juvenile or adult), weight in grams, and reproductive condition (if discernible). All bats were marked with a small dab of white-out to account for recaptures and released at the site of capture. Additional information recorded includes the climatalogical conditions, date, time of capture, lunar phase, and percent cloud cover. Species identification was based on the keys described by Belwood (1998).

## Site Selection and Descriptions

Potential flight corridors within this study included bridges over entrenched drainage ditches (Prairie Creek and Blue Creek), narrow forested riparian areas and one old forested oxbow with enclosed tree canopy. A hand-held ultrasound detector (Peterson Model D-100) and an ANABAT unit were used to monitor bat activity at the site and to identify additional areas for the placement of mist nets.

A description of each site and net-set is provided below and shown on the map in Appendix A and B. Appendix C includes photographs of each net set.

# Results

## *Site A (July 1, July 3) (total net nights = 8)*

Site A was monitored on July 1 and 3. Both nights were clear with no cloud cover, no precipitation and no wind. The moon was approximately ¼ full each night but was low on the horizon, late rising and did little to deter bats from flying. On July 1, 2010 temperatures ranged from 70 degrees when nets were first raised for the evening (9:15 PM) to a low of 52 degrees when nets were finally lowered for the evening (2:30 AM). July 3, 2010 was warmer with a high of 80 degrees when nets were raised for the evening (9:10 PM) to a low of 60 degrees when nets were finally lowered and dismantled (2:15 AM).

### *Descriptions of Net Sets*

Net A1 consisted of two tiers of 6-meter mist nets stacked vertically under a bridge over Hagerman Creek (a tributary to Prairie Creek). At this location, it was possible to block off most of the potential flight corridor.

Net A2 consisted of two tiers of 12-meter mist set over a deeply entrenched portion of Hagerman Creek. A third 6-meter net was added at the bottom of the set to close off the lowest portion of the ditched stream. The right bank of the stream supported a narrow band of trees and the depth of the ditch added to allow partial blockage of the flight corridor.

Net A3 consisted of two tiers of 9-meter mist nets stacked vertically under a bridge over Prairie Creek. At this location, it was possible to entirely block off the flight corridor.

Net A4 consisted of a single 6-meter mist net set over an old access bridge over Prairie Creek in an area with sparse riparian vegetation. At this location, it was possible to entirely block off the potential flight corridor.

## *Site B (July 2, July 4) (total net nights = 8)*

Site B was monitored on July 2 and 4. July 2 was clear with no cloud cover, no precipitation and no wind. The moon was approximately ¼ full each night but was low on the horizon, late rising and did little to deter bats from flying. On July 2, 2010 temperatures ranged from 68 degrees when nets were first raised for the evening (9:15 PM) to a low of 54 degrees when nets were finally lowered for the evening (2:30 AM). July 4, 2010 was warmer and humid with a high of 82 degrees when nets were raised for the evening (9:00 PM) to a low of 72 degrees when nets were finally lowered and dismantled (2:00 AM). Skies were 100% clouded and a brief shower occurred at approximately 11:30 PM. The shower lasted only 20 minutes and did not significantly deter bats from flying. Although the moon was ¼ full, the dense clouds blocked most light for most of the evening.

### *Descriptions of Net Sets*

Nets B1 and B2 were each placed over Cunningham Creek (a tributary to Blue Creek). Net B1 consisted of two tiers of 6-meter mist nets stacked vertically to the underside of the tree canopy and net B2 consisted of three tiers of 6-meter mist nets stacked vertically and raised to the underside of the tree canopy over the riparian area. This section of creek has been severely channelized and represented an excellent flight corridor.

Net B3 consisted of a single 6-meter mist net set over Blue Creek at a location where an overarching willow tree allowed for partial blockage of the flight corridor.

Net B4 consisted of three tiers of 6-meter mist nets stacked vertically and raised to the underside of the tree canopy over a marshy area that appears to be an old oxbow of the original stream corridor prior to ditching and draining of the region for agriculture. At this location, it was possible to entirely block off the potential flight corridor.

## *Mist-Netting Survey*

Only two species of bats were noted during the course of this investigation. Big brown bat and red bat are considered common species and well adapted to life in disturbed environments reflective of intense agricultural use.

Overall activity was very low. Only a few bats were visually observed at dusk in any location. Several of the big brown bats were lactating females and indicative of a roost site somewhere within the project area but low catch numbers did not justify radio-telemetry for any individuals of this species.

Bat calls were collected at all sites and analyzed. Very few bat calls were detected and most were either big brown or red bats.

No state or federally listed species were noted during the course of this investigation.

***Table 1. Species List and Biological Data***

| Date | Time | Species | Net | Forearm (mm) | Weight (g) | Gender | Age | Left Wing | Right Wing | Breeding Status |
|---|---|---|---|---|---|---|---|---|---|---|
| 7-2 | 9:30 PM | Red Bat | B4 | 38 | 11.25 | F | A | 0 | 0 | Lactating |
| 7-2 | 9:30 PM | Big Brown Bat | B4 | 46 | 18 | F | A | 0 | 0 | Lactating |
| 7-2 | 10:00 PM | Big Brown Bat | B4 | 43 | 15 | M | A | 0 | 0 | N/A |
| 7-2 | 10:00 PM | Red Bat | B4 | 45.5 | 16 | M | A | 0 | 0 | N/A |
| 7-2 | 9:50 PM | Big Brown Bat | B2 | 49 | 20 | F | A | 0 | 1 | Lactating |
| 7-2 | 10:00 PM | Big Brown Bat | B2 | escaped | | M | A | 0 | 0 | N/A |
| 7-2 | 10:25 AM | Red Bat | B2 | | 14.5 | M | A | 0 | 0 | N/A |
| 7-4 | 11:45 PM | Big Brown bat | B2 | 47 | 15 | M | A | 0 | 0 | N/A |

# *Summary and Discussion*

A survey for bats was performed at the Northwest Wind Energy Site in Paulding County, Ohio. The study included two sites (16 net nights) over Blue Creek and Prairie Creek (and associated tributaries).

Only two species of bats were encountered during the course of this investigation. Both the red bat and big brown bat are considered common species and well adapted to agricultural settings. Both species were encountered in very low numbers which is likely reflective of the overall poor habitat and marginal netting conditions.

## *References and Suggested Reading*


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Brady, J.T., R.K. LaVal, T.H. Kunz, M.D. Tuttle, D.E. Wilson, and R.L. Clawson. 1983. *Recovery Plan for the Indiana Bat.* U.S. Fish and Wildlife Service. 80 pp.

Gottschang, J. L. 1981. *A Guide to the Mammals of Ohio.* The Ohio State University Press, Columbus. xi + 176 pp., 13 plates.

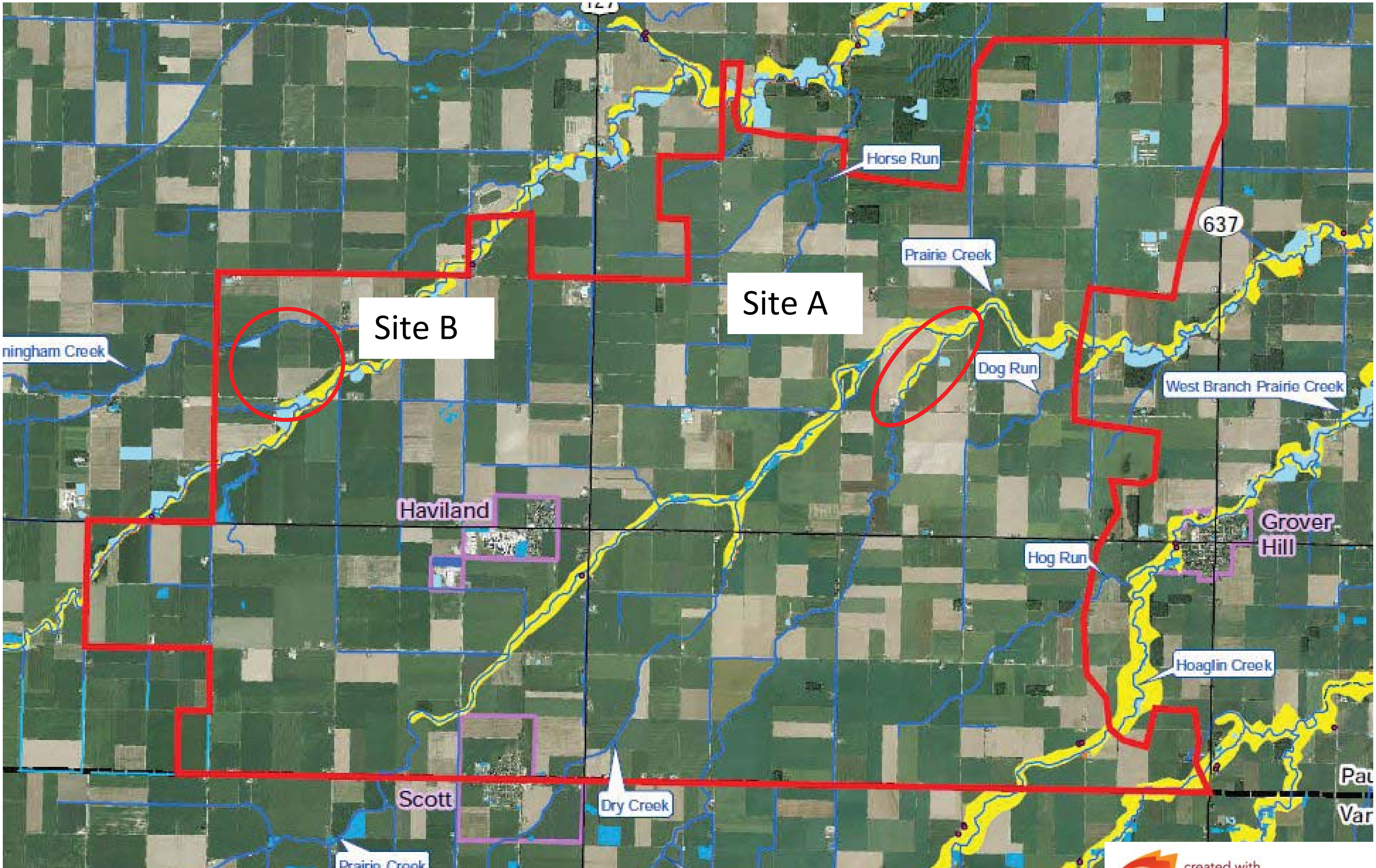
Humphrey, Stephen R., A.R. Richter, and C. James. 1977. *Summer habitat and ecology of the endangered Indiana bat (Myotis sodalis).* J. Mamm. 58:334-346.

Kurta, Allen, D. King, J.A. Teramino, J.M. Stribley, and K.J. Williams. 1993. *Summer roosts of the endangered Indiana bat (Myotis sodalis) on the northern edge of its range.* Am. Midl. Nat. 129:132-138.

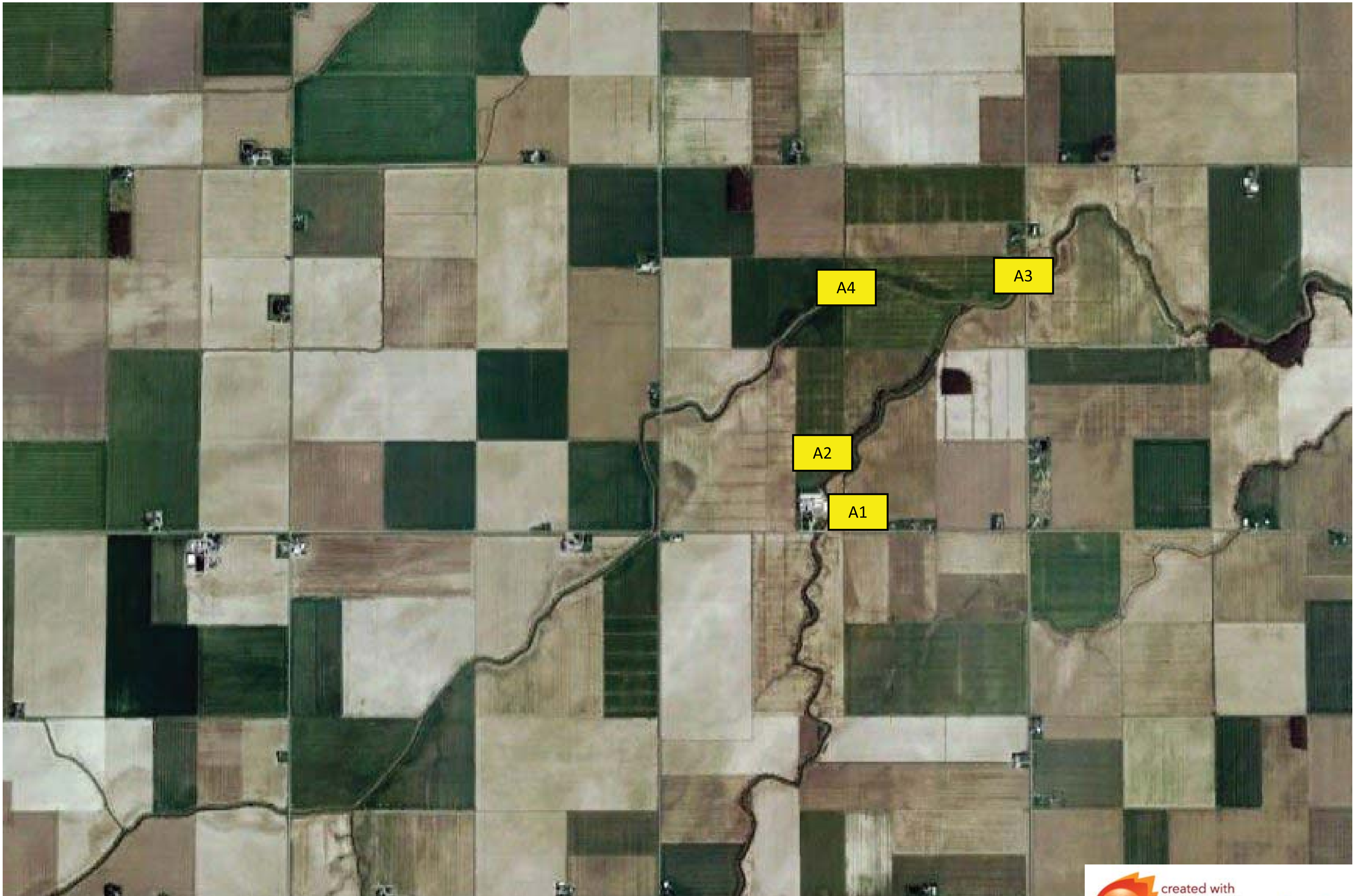
Kunz, T.H. ed. 1988. *Ecological and Behavioral Methods for the Study of Bats.* Smithsonian Institution Press, Washington.

# *Attachment A*
# *Maps of Sites and Locations of Net Sets*

# Northwest Ohio Wind Energy – Overview of Area and Location of Sites



# Northwest  Ohio Wind Energy – Site A Net Locations



# Northwest Ohio Wind Energy – Site B Net Locations

# *Attachment B*
# *Photographs of Net Sets*


Net A1


Net A2

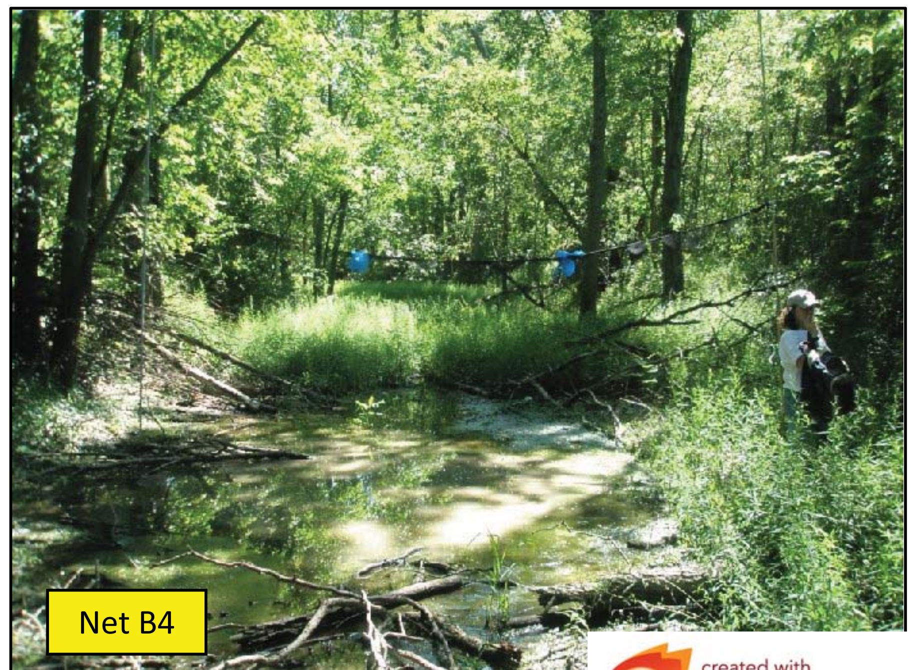

Net A3


Net A4


Net B1


Net B2


Net B3


Net B4

# *Attachment C*
# *Photographs of Bat Species*


Adult female red bat (lactating)


Adult male big brown bat

# *Paulding County: North West Ohio*

# *Draft Report:*

# *Pre-Construction Acoustic Monitoring*

March 2011

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## Introduction

A wind energy project is planned for Paulding County in Northwest Ohio (Appendix A, Maps). The Ohio Department of Natural Resources has developed a set of protocols to determine potential impacts to bats associated with new wind energy projects. Wind energy providers are encouraged to adopt these procedures and initiate coordination with Ohio Department of Natural Resources at the earliest possible date.

The United States Fish and Wildlife Service and the Ohio Department of Natural Resources, Division of Wildlife have previously reviewed habitat data for the proposed facility. Based upon their review of the project, state and federal regulatory agencies recommended an acoustic monitoring survey to more fully understand the use of this area by bats. This report details the results of an acoustic monitoring study as previously recommended by state and federal regulatory agencies.

## Bats and Wind Energy

To date, bat activity at proposed wind farm installations has primarily been studied using acoustic monitoring. In recent years, bat fatalities at post-construction wind facilities have been monitored by routinely searching for carcasses. Fatality searches have found that most bat fatalities caused by wind turbines occur during migration periods, with the greatest numbers during the fall migration season. These fatalities have raised concerns about possible impacts on bat population decline and have resulted in increased requests for pre-construction acoustic monitoring studies such as this study in Paulding County. In North America, it has been observed that bat fatalities are primarily migratory tree bats: hoary bats, eastern red bats and silver-haired bats (Arnett et al. 2008; Johnson 2005).

## Bat Biology

There are eleven species of bats found in Ohio and while most of them hibernate through the winter in rock crevices, hollowed trees, and caves, the Hoary bat, Silver-Haired and the Eastern Red bat are three species of migratory bats in Ohio. Even resident cave hibernators may migrate significant distances between winter hibernacula and summer maternity sites. Migratory bats may be especially vulnerable to wind facility development in the fall when a large amount of bat activity occurs late August through October.

Migration occurs twice yearly in the spring and fall. Bats in Ohio hibernacula typically begin emerging when daytime temperatures reach 45-50 degrees Farenheit, and spring migration can begin within days or weeks of a bat’s first emergence. Bats can begin their migration as early as the middle of March through the middle of May.

The migratory behavior and pathways of bats is poorly studied. Factors that confound research in this area are related to their nocturnal habits and difficulty in tracking individual bats. It is presently uncertain if bats always follow specific migratory routes or are more dispersed as they move between summer roosting areas and wintering areas and hibernacula. Research with avian fauna reveal that birds use a variety of visual and nonvisual cues for orientation and navigation, which interact with genetic cues during migration (Able 1980; Berthold and Terrill 1991; Wiltschko and Wiltschko 1999). It is possible that bats rely on similar environmental and genetic factors although it is unlikely that bats use echolocation to navigate long distances due to atmospheric attenuation of high frequency sounds (Altringham and Fenton 2003; Griffin 1970; Neuweiler 2000). Various scientific studies have determined that bats have excellent spatial memory (Baker 1978; Griffin 1970; Holland et al. 2005; Holler and Schmidt 1996), and are capable of perceiving stars (Childs and Buchler 1981), post sunset glow (Buchler and Childs 1982), the Earth's magnetic field (Holland et al. 2006, 2008), and geographical landmarks and linear features (Ahlen 1997; Barclay 1984; Johnson et al. 2004; Limpens et al. 1989; Racey and Entwistle 2003; Serra-Cobo et al. 2000; Timm 1989). All of these visual cues could be used for orientation and navigation. It does seem likely that bats use a combination of sensory systems for orientation and navigation and probably use pathways near prominent landscape features as geographical aides, such as rivers and mountains. Like birds, bat sensory systems could be interacting with genetic information to provide a map and compass for long-distance migration (Holland 2007).

Migration expends a great deal of energy, and long-distance migration requires suitable stopover sites to drink, roost, and forage. The availability of stopover habitats and daily roosting sites may influence bat migration as is the case with bird migration (Berthold 2001; Catry et al. 2004; Cryan and Veilleux 2007). If suitable sites are not distributed uniformly, then migrating bats are likely to be more concentrated near better sites suited for drinking, roosting and foraging during migration stopovers. Areas that have been developed for agriculture often have patchy natural habitats that might induce large seasonal clusters of migratory birds and bats.

Higher bat activity (Arnett et al. 2006, 2007b, Redell et al. 2006, Reynolds 2006, Weller 2007) and fatalities (Arnett et al. 2008) have been consistently correlated with periods of low wind speed and weather conditions typical of the passage of storm fronts. The reason for this correlation is not clear but it could be that migration is less efficient for bats in high wind speeds and thus migratory movement in these conditions is reduced (Baerwald et al. 2009). Cryan and Brown (2007) reported that fall arrivals of hoary bats on Southeast Farallon Island were related to periods of low wind speed, dark phases of the moon, and low barometric pressure, which also supports theories that bat migration can be predictable.

## *Bats of Ohio*

Eleven species of bats are known to inhabit the State of Ohio. The Indiana bat is both a state and federally listed endangered species. In addition, Rafinesque big-eared bat and small footed bat are state protected species. Any of these bats could potentially be present within the confines of the study area.

Big brown bat (*Eptesicus fuscus*)
Little brown bat (*Myotis lucifugus*)
Northern long-eared bat (*Myotis septentrianalis*)

Indiana bat (*Myotis sodalis*)
Tri colored bat (*Perimyotis subflavus*)
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Hoary bat (*Lasiurus cinereus*)
Silver haired bat (*Lasionycteris noctivagans*)
Small footed bat (*Myotis leibii*)
Evening bat (*Nycticeius humeralis*)
Rafinesque big-eared bat (*Corynorhinus rafinesquii*)

## Methods

Methods employed in this investigation were specified by the ONDR. The ODNR protocol specifies that acoustic monitoring should be performed continuously from March 15-November 15 at two heights: 5 meters and as close as possible within the rotoswept area (40 meters in this study). Bat calls were recorded from the evening of March 15 – November 15, 2010. Photographs illustrating the installation process and equipment is presented in Appendix D.

A full season of bat activity was monitored at the Paulding, Ohio MET Tower site from March 15-November 15 using two SD1 Anabat units (SN#05914 and SN#05900) manufactured by Titley electronics. Unit #05914 recorded calls from 5 meters and unit #05900 recorded at 40 meters. The sensitivity dials on both units were calibrated on a straight-line laser beam jig to detect 40 kilohertz (kHz) and 80 kilohertz tones from a distance of 20 meters. The units were calibrated at an environmental temperature of approximately 68 degrees Fahrenheit and 45% humidity.

Installation at the MET tower site (N 41 00.380, W 84 37.777 ) began on February 12, 2010; the same day that two pulley systems were installed at 40 meters and 5 meters onto the MET Tower. However, data recording did not begin until March 13 because three additional visits were needed due to equipment problems with the Titely remote GML1 monitor units. Despite the problems with the GML1 units, data was continually recorded on both Anabat units beginning March 13, 2010.

<u>*Discussion regarding GML1(remote wireless data transmitter) mechanical problems:*</u>
The first two installation visits were on February 12 and March 7. Both of these resulted in a GML1 unit shorting out. It was determined that a sneak short circuit caused the malfunction that resulted from too many electrical draws on the single12 volt battery. During the first two visits, the set up was such that two anabat units and two GML1 units all utilized a single 12 volt battery and was housed in one weatherproof enclosure. Titley technicians were consulted regarding the electrical issues, and the solution was to create two separate recording and transmission systems in two enclosures. On the third visit on March 13, a second box was attached to the tower and the systems were separated, each with a single GML1 unit, Anabat unit, charging harness and 12 volt battery, each powered separately by a solar panel and separate charging harness (1:1:1:1 ratio). This new set-up eliminated the short circuit and the GML1 units and Anabat units were operational and recording.

The units began continuous recording beginning March 13. It was decided to collect data manually due to issues with the GML1 (wireless connection) units. There was no loss of data which was manually collected by a fourth site visit on April 1st.

Final equipment used during this project included two separate recording systems housed in two weatherproof locked boxes affixed to the MET tower. Each box housed a 12 volt battery, Anabat SD1 unit and solar charging harness attached to a south facing 10 watt solar panel (Appendix D, Photographs). The bat hat systems (including pre-amp shroud, 45 degree angled reflector plate, and a Titley electronics standard microphone) and microphone cables were secured to the 40 meter pulley system and 5 meter pulley system and raised up the MET tower. The orientation of the reflector plates were NE 38 degrees at 40 meters and SE 140 degrees at 5 meters.

## *Data Collection*

Bat echolocation calls were recorded from the evening of March 15th – November 15th each day beginning at a minimum of 30 minutes before sunset and ending at a minimum of 30 minutes after sunrise. The data were stored on compact flash cards which were collected bi-weekly by a local field assistant. Flash cards were then mailed to Tragus for analysis. On April 1st, 2010 the field assistant was provided with written and verbal instructions and on-site field training regarding flash card exchange. The field assistant demonstrated good understanding and was proficient in performing the task several times under Tragus' supervision. With the exception of one flash card exchange performed on September 27 on the 5 meter height unit, all of the data throughout the study were viable thus indicating good equipment operation, data storage, and proper flash card exchange by the field assistant. On September 27, the field assistant did not leave the 5 meter unit powered on, thus data was not recorded at 5 meters from September 27 through October 20. The ODNR was notified of the missing data and communicated that although the data loss is unfortunate it is not a deterrent to the efficacy of this study.

In accordance to the ODNR protocol, a bat echolocation call "passes" were identified as $\geq 2$ echolocation pulses and when possible were identified to species or species groups, such as big brown/silver-haired [EPFULANO] (Betts, 1998). All call files are provided to state and federal agencies along with this report. Call files that were indeterminate and could therefore not be identified to species or species group have been counted and grouped by characteristic frequency, such as Q25. For example, a Q25 grouping indicates that the call is an indeterminate species and also is an indeterminant species group; and therefore the only classification we can give the call is characteristic frequency of 25 kilohertz.

The format of the recorded bat passes are Anabat data files and they are named as such: "*K (year 2010, L will be 2011), month (0-9 then A,B,C Oct-Dec), day, hour, minute, second #*"

> Anabat data file examples: **K8230047.18#** Anabat data file indicates the file was recorded on August 23rd, 2010 at 00:47 hours and 18 seconds, and **LB062318.57#** Anabat data file indicates the call was recorded on November 6th, 2011 at 23:18 hours and 57 seconds.

Anabat data files are viewed as individual sonograms (Appendix C, Figure) using AnalookW software available on-line at:
http://users.lmi.net/corben/anabat.htm#Latest%20AnalookW%20Software.

Individual call files were labeled in Analook W with these abbreviations:

*Low Frequency Bat Group (characteristic frequency (cF)) < 30 kHz)*

| | |
|---|---|
| LACI: | Hoary bat (*Lasiurus cinereus*) |
| Q25: | cF = 25 kHz, not identifiable to species or species group |
| EPFU: | Big brown bat (*Eptesicus fuscus*) |
| EPFULANO: | Calls where big brown and silver haired could not be differentiated |
| LANO: | Silver haired bat (*Lasionycteris noctivagans*) |

*High Frequency Bat Group (characteristic frequency (cF)) > 30 kHz)*

| | |
|---|---|
| LABO: | Eastern red bat (*Lasiurus borealis*) |
| PESULABO: | Calls where Tri colored bat and Eastern red bat could not be differentiated |
| LABONYHU: | Calls where eastern red bat and evening bat could not be differentiated |
| PESU: | Tri colored bat (*Perimyotis subflavus*) |
| Q40: | cF = 40 kHz, not identifiable to species or species group |
| MYSP: | Genus Myotis that could not be identified to species |
| Q45: | cF = 45 kHz, not identifiable to species or species group |

# Results

Detailed results and analysis are provided in Appendix B.

Totalling all recorded sound files from both units at 5 meters and 40 meters, there were 129,276 miscellaneous sound files and 2,954 recorded bat call passes ≥ 2 echolocation pulses which identified 5 species of bats (Big Brown, Silver Haired, Eastern Red, Hoary, and Tri colored bats) at the Paulding County, Ohio MET tower between March 15 and November 15, 2010. The average number of nightly bat passes was 26 in July, 38 in August, and 18 in September. The highest activity was July through mid-September from 9:00-10:00pm and again at 5:00am. As previously noted in Data Collection, the 5 meter Anabat unit did not record from September 27 – October 20.

**Species and Species Groups >1% of total recorded calls from both units (5m and 40m):**

| | |
|---|---|
| Big Brown | 33% |
| Q25 | 28% (likely Big Brown, Hoary, or Silver Haired) |
| Big Brown/Silver Haired | 18% |
| Eastern Red | 15% |
| Hoary | 4% |
| Silver Haired | 2% |

**Species and Species Groups <1% of total recorded calls from both units:**

| | |
|---|---|
| Q40 | (13) |
| Myotis | (6) |
| Red Bat/Evening Bat | (6) |
| Tri-colored | (4) |
| Tri-Colored/Red Bat | (4) |
| Q45 | (2) |

## *Summary and Discussion*

The purpose of this data is to assist the state and federal regulatory agencies in determining the effects a wind turbine facility in Paulding County, Ohio might contribute to bat fatalities during seasonal migrations and summer life cycles.

In this study, a total of 5 species were recorded, primarily consisting of big brown, eastern red, hoary, and silver haired respectively. Big brown bats migrate short distances to underground crevices and caves where temperatures remain stable throughout the winter. Eastern red, hoary, and silver haired bats are three of Ohio's more common and widely dispersed tree bats. In recent carcass searches at post-construction wind energy facilities, tree bats have been found to be at greatest risk, particularly during spring and fall migration seasons (Arnett et al. 2008; Johnson 2005).

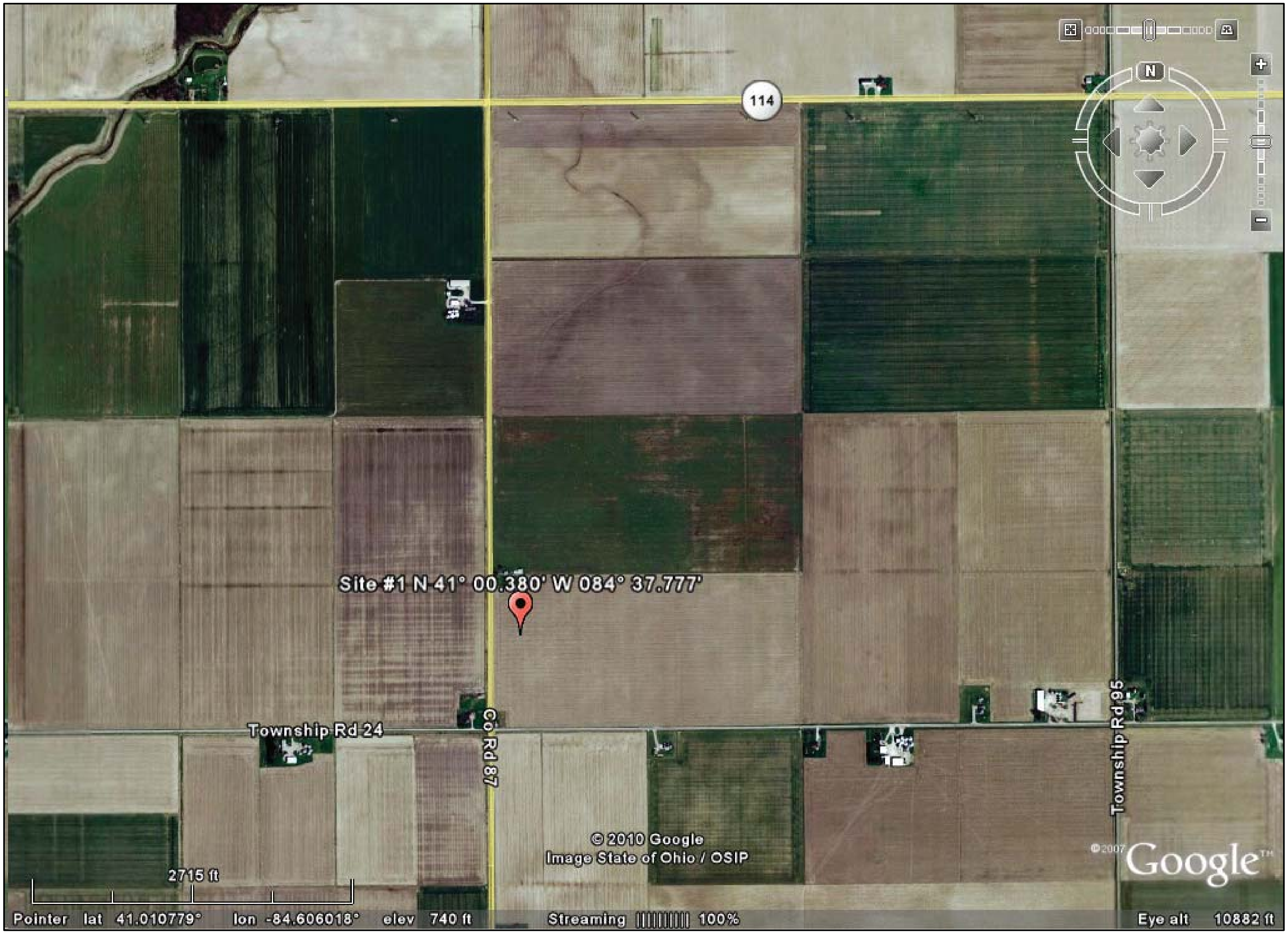
Although the roosting habitat and drinking sources in a 10-15 mile circumference around the MET tower are of moderate to low quality to bats, the agricultural fields provide a near constant foraging source for summer residents, and is being utilized primarily from late June through mid September.

When woodland foraging is limited, bats have been observed spending 50% or more of their foraging efforts in nearby agricultural fields. Although many conservation plans are aimed at protecting bat roosting sites, available foraging habitat needs to be considered when woodland resources are limited.

These data indicate normal patterns of a local bat population that are roosting and foraging; the data indicate little or no spring migration and a low volume of fall migration from mid-August to mid-September.

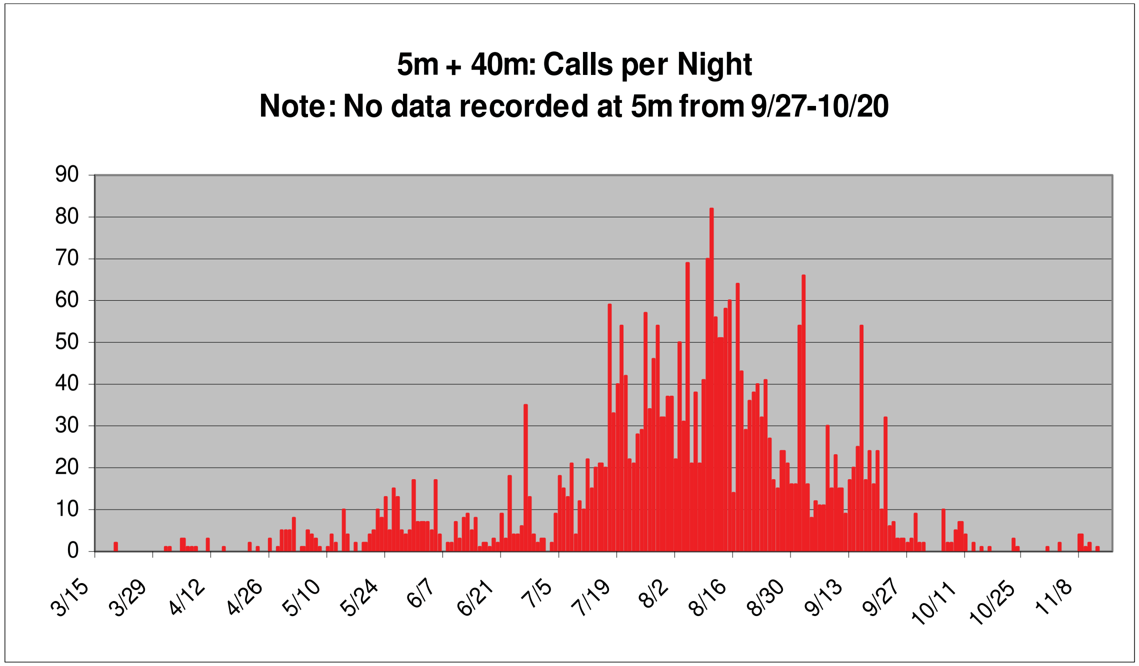
# *Appendix A – Maps Showing Location of MET Tower and ANABAT Installation*

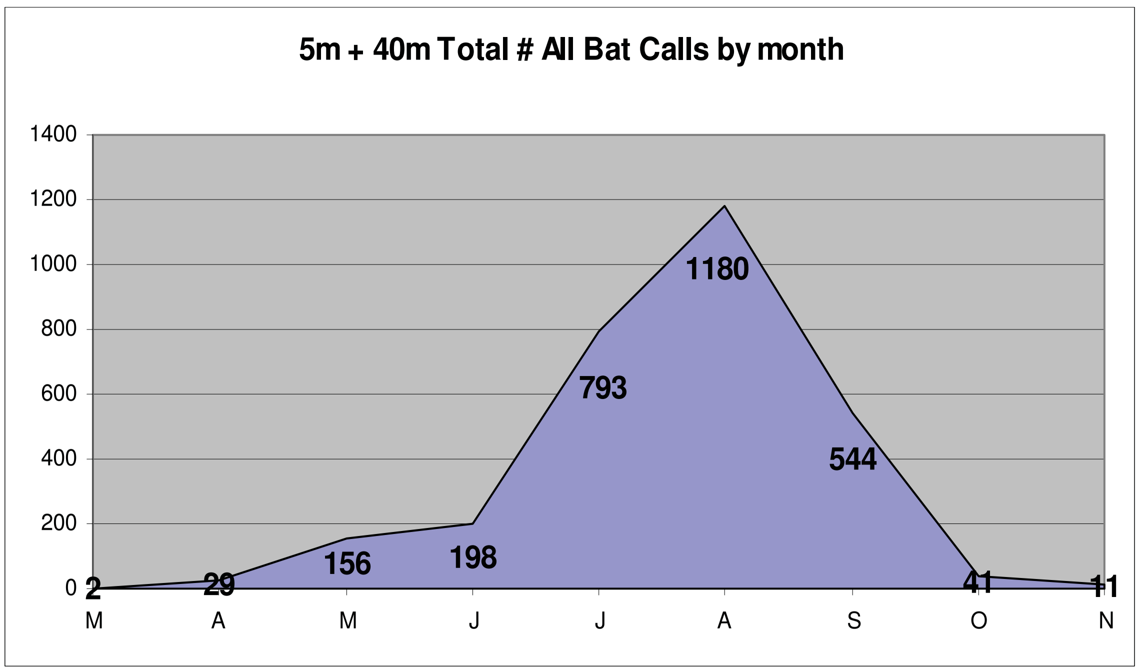
# MET Tower: N 41 00.380  W 084 37.777

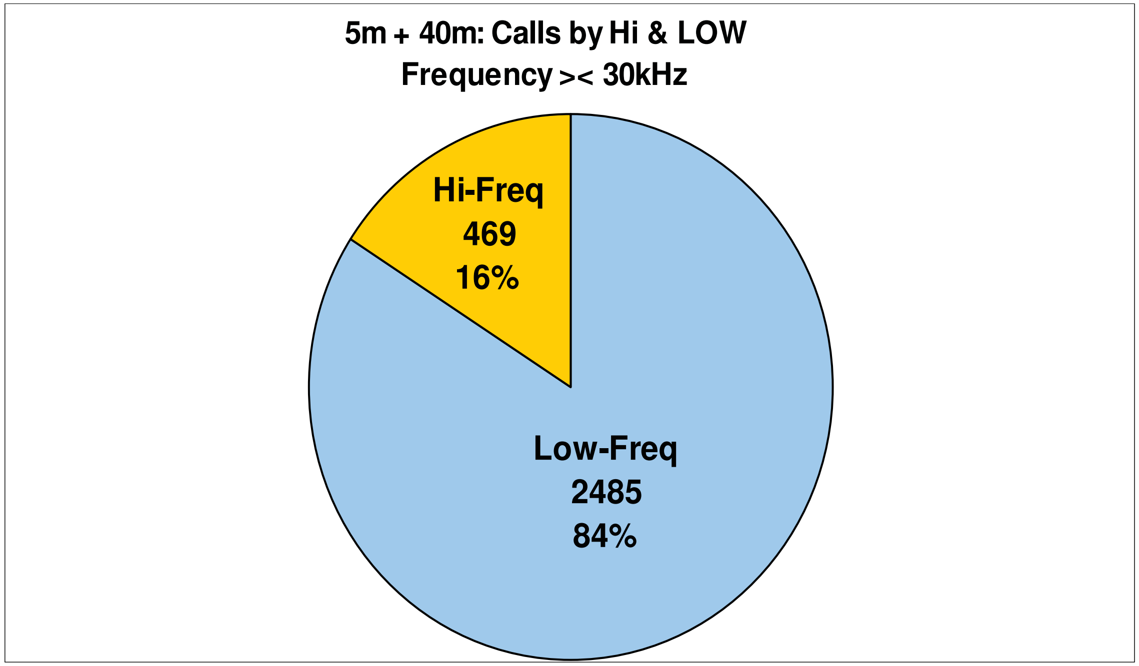


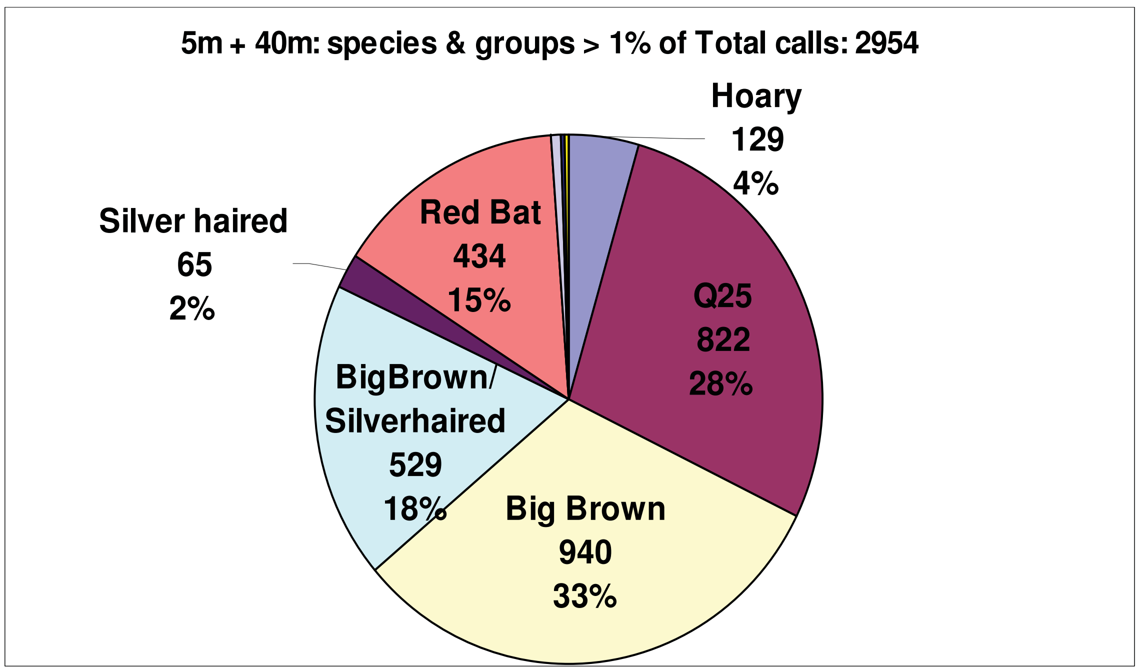
# MET Tower: Paulding County, Ohio

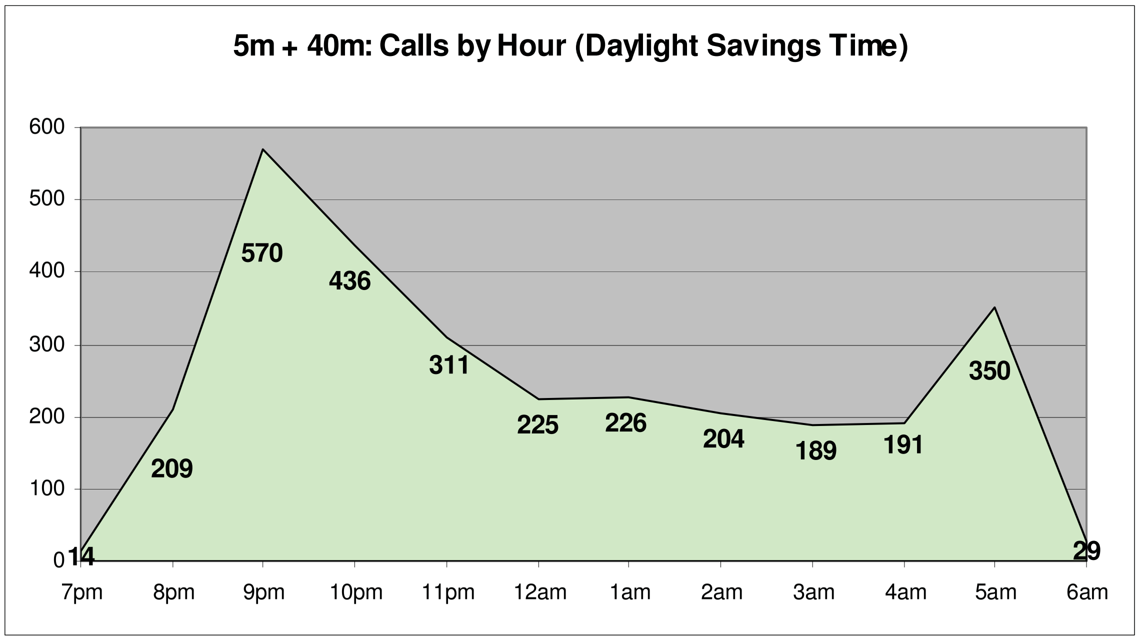
# *Appendix B – Acoustic Data Graphical Analysis and Illustration*

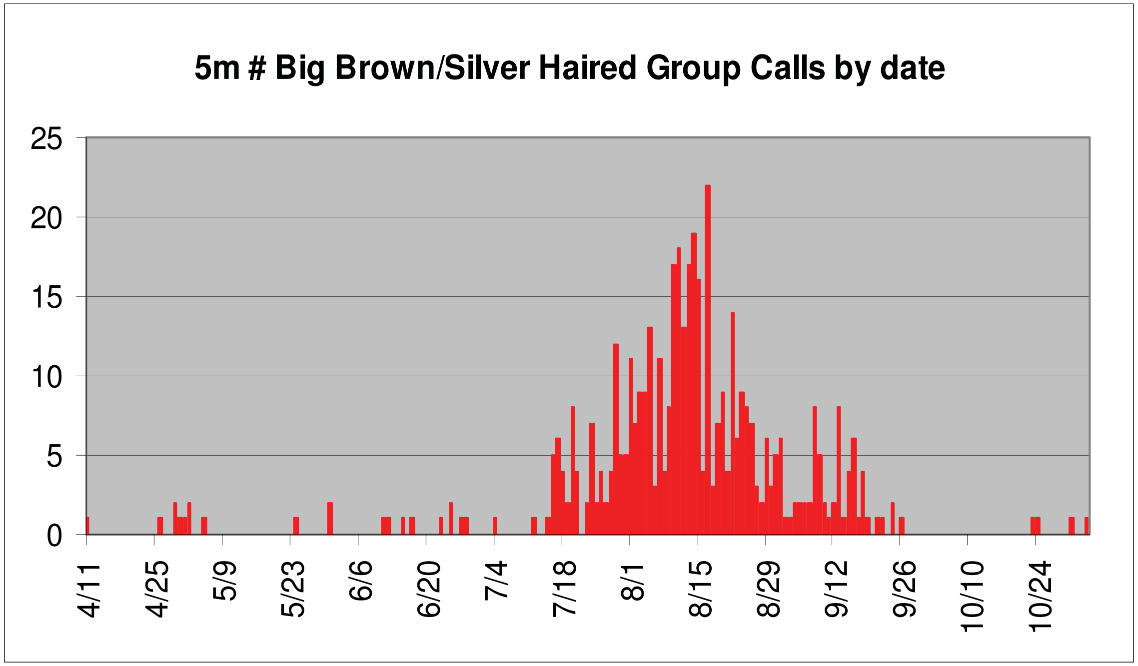

5m + 40m: Calls per Night
Note: No data recorded at 5m from 9/27-10/20
90
80
70
60
50
40
30
20
10
0
3/15
3/29
4/12
4/26
5/10
5/24
6/7
6/21
7/5
7/19
8/2
8/16
8/30
9/13
9/27
10/11
10/25
11/8

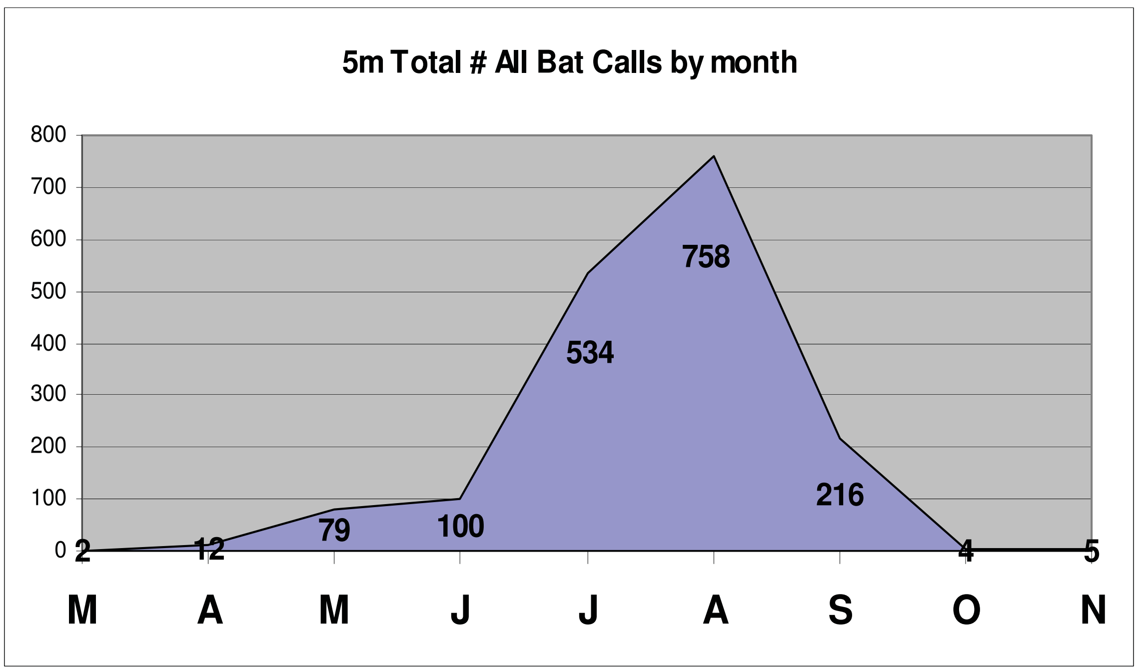

5m + 40m Total # All Bat Calls by month
1400
1200
1000
800
600
400
200
0
2
29
156
198
793
1180
544
41
11
M
A
M
J
J
A
S
O
N

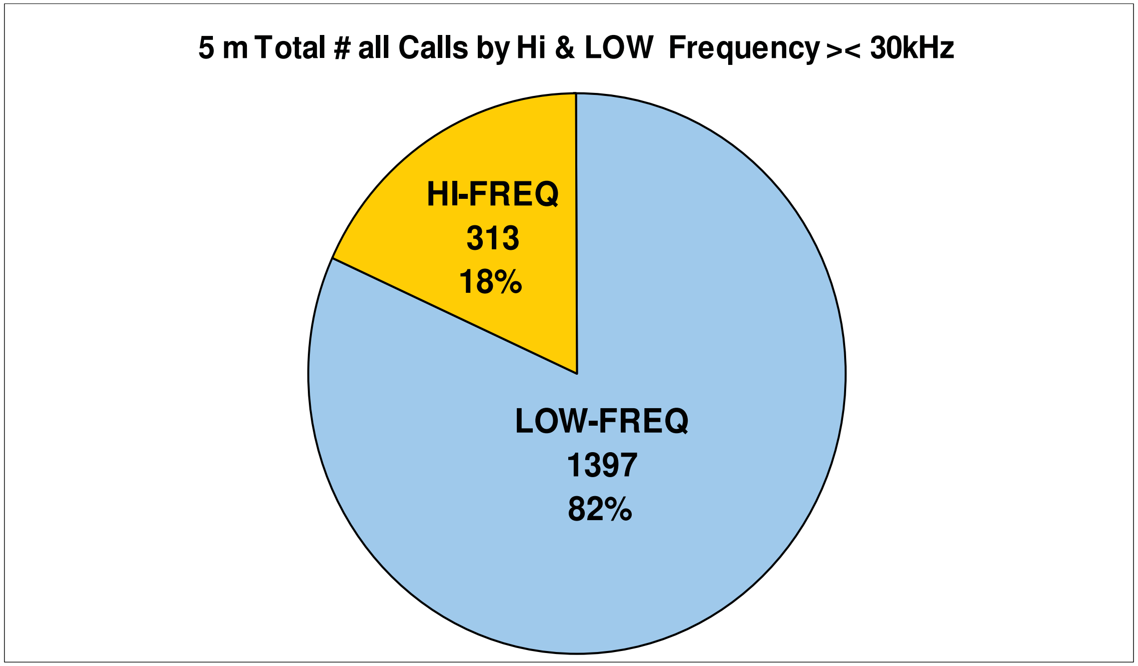

5m + 40m: Calls by Hi & LOW
Frequency >< 30kHz
Hi-Freq
469
16%
Low-Freq
2485
84%

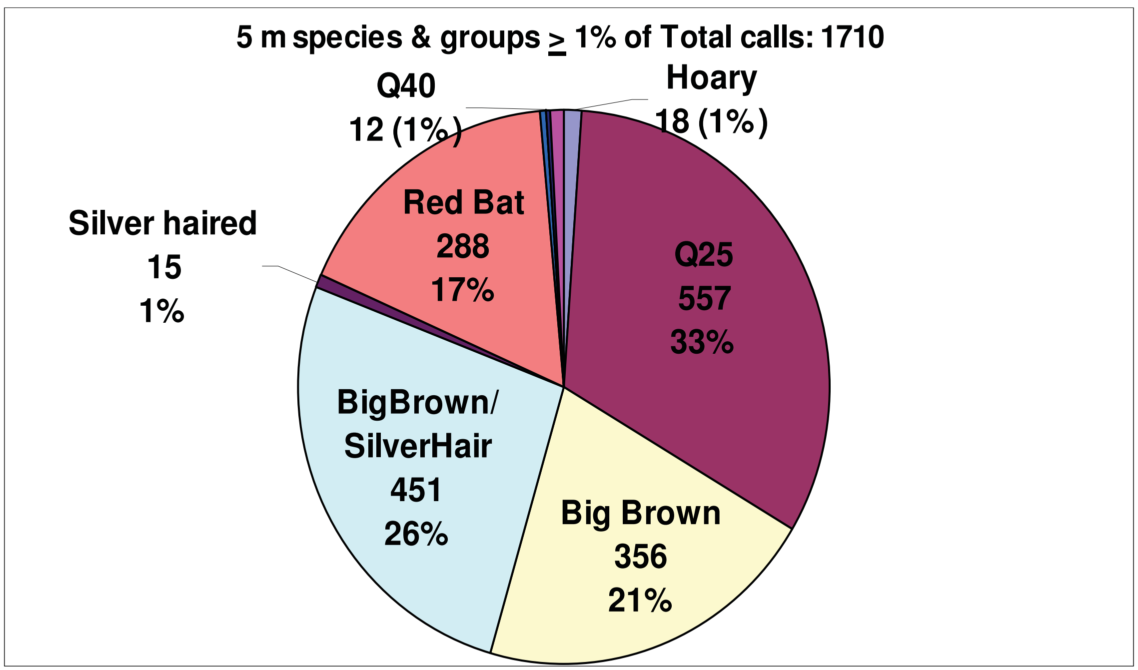

5m + 40m: species & groups > 1% of Total calls: 2954
Hoary
129
4%
Silver haired
65
2%
Red Bat
434
15%
Q25
822
28%
BigBrown/
Silverhaired
529
18%
Big Brown
940
33%

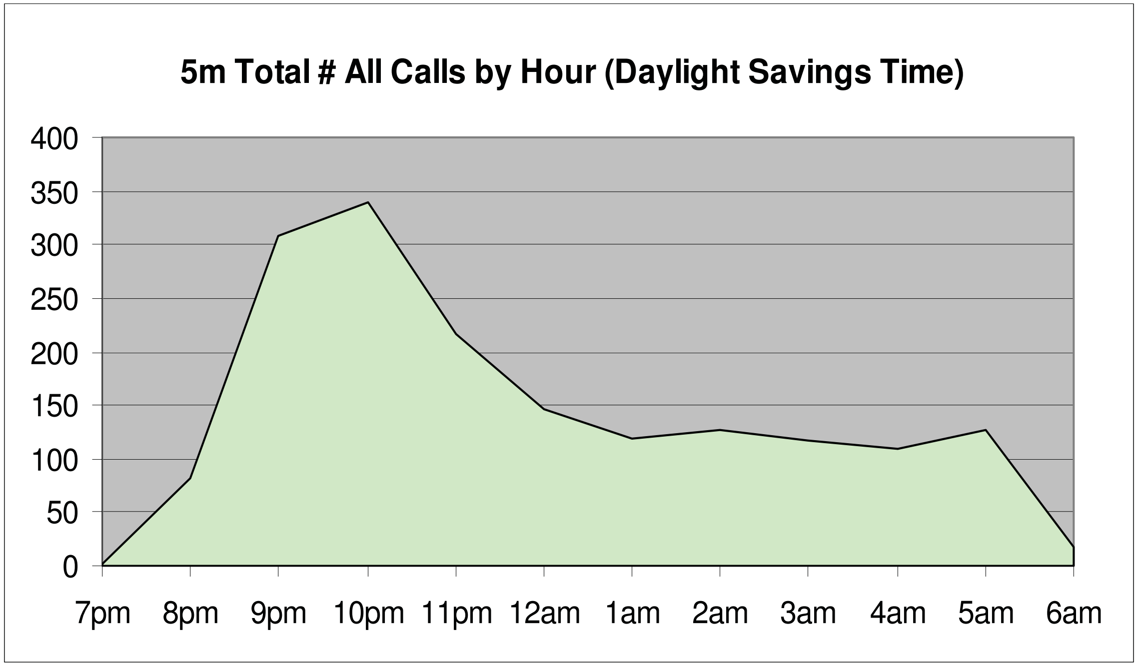

5m + 40m: Calls by Hour (Daylight Savings Time)
600
500
400
300
200
100
0
14
209
570
436
311
225
226
204
189
191
350
29
7pm
8pm
9pm
10pm
11pm
12am
1am
2am
3am
4am
5am
6am

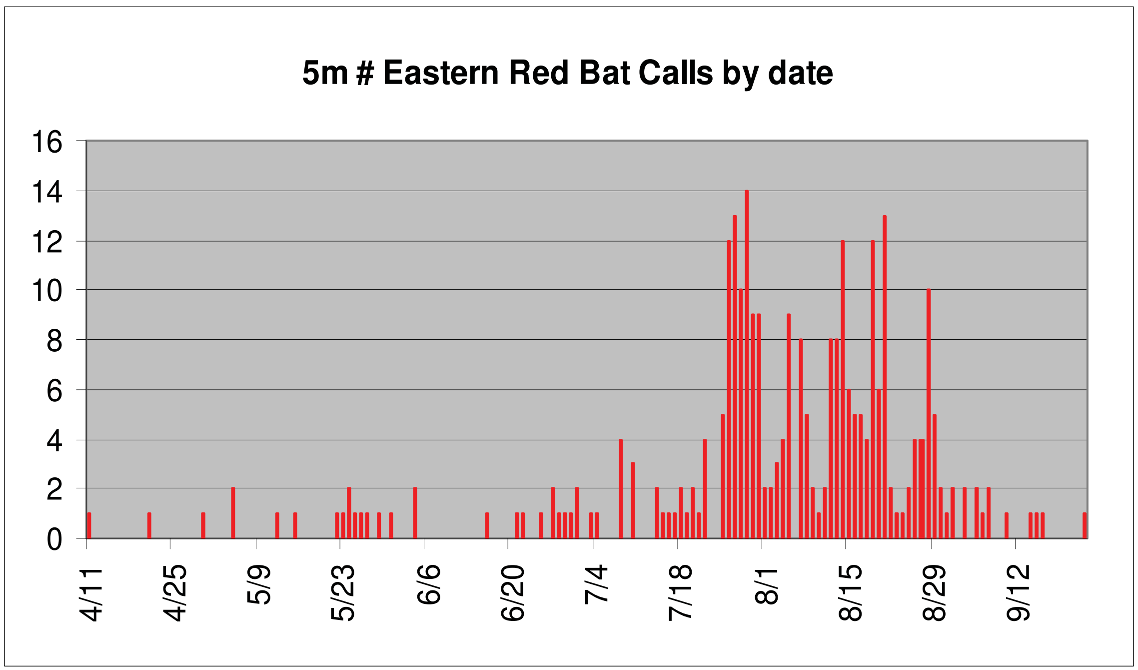

5m # Big Brown/Silver Haired Group Calls by date
25
20
15
10
5
0
4/11
4/25
5/9
5/23
6/6
6/20
7/4
7/18
8/1
8/15
8/29
9/12
9/26
10/10
10/24


5m Total # All Bat Calls by month
800
700
600
500
400
300
200
100
0
2
12
79
100
534
758
216
4
5
M
A
M
J
J
A
S
O
N

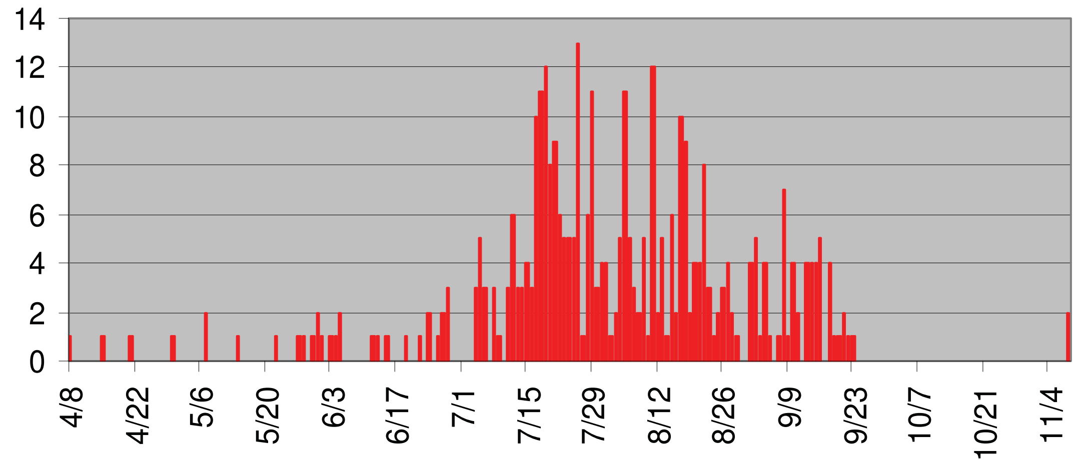

5 m Total # all Calls by Hi & LOW Frequency >< 30kHz
HI-FREQ
313
18%
LOW-FREQ
1397
82%


5 m species & groups ≥ 1% of Total calls: 1710
Q40
12 (1%)
Hoary
18 (1%)
Silver haired
15
1%
Red Bat
288
17%
Q25
557
33%
BigBrown/
SilverHair
451
26%
Big Brown
356
21%

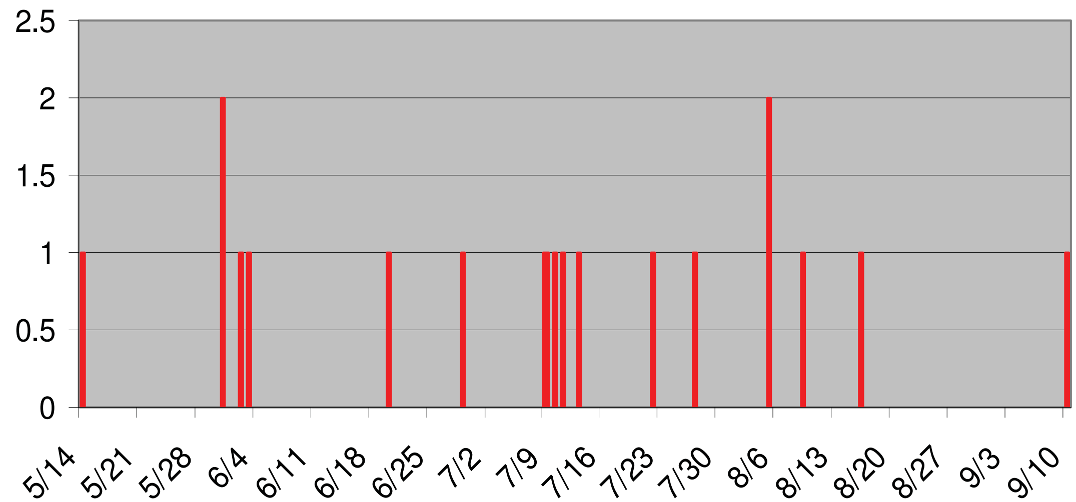

5m Total # All Calls by Hour (Daylight Savings Time)
400
350
300
250
200
150
100
50
0
7pm
8pm
9pm
10pm
11pm
12am
1am
2am
3am
4am
5am
6am

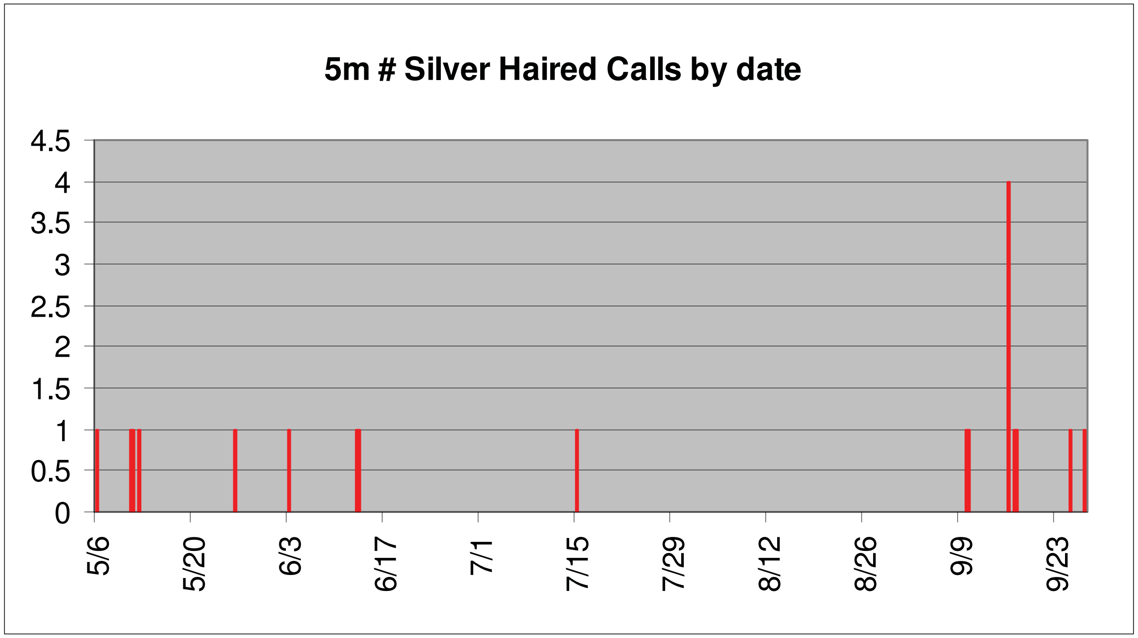

5m # Eastern Red Bat Calls by date
16
14
12
10
8
6
4
2
0
4/11
4/25
5/9
5/23
6/6
6/20
7/4
7/18
8/1
8/15
8/29
9/12

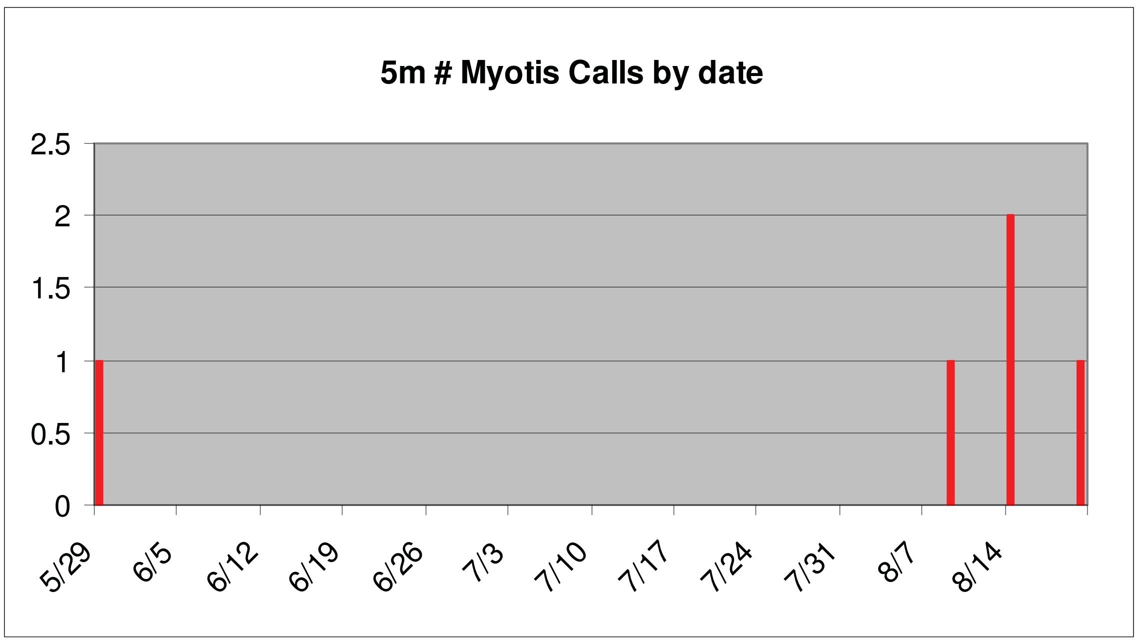
5m # Big Brown Calls by date

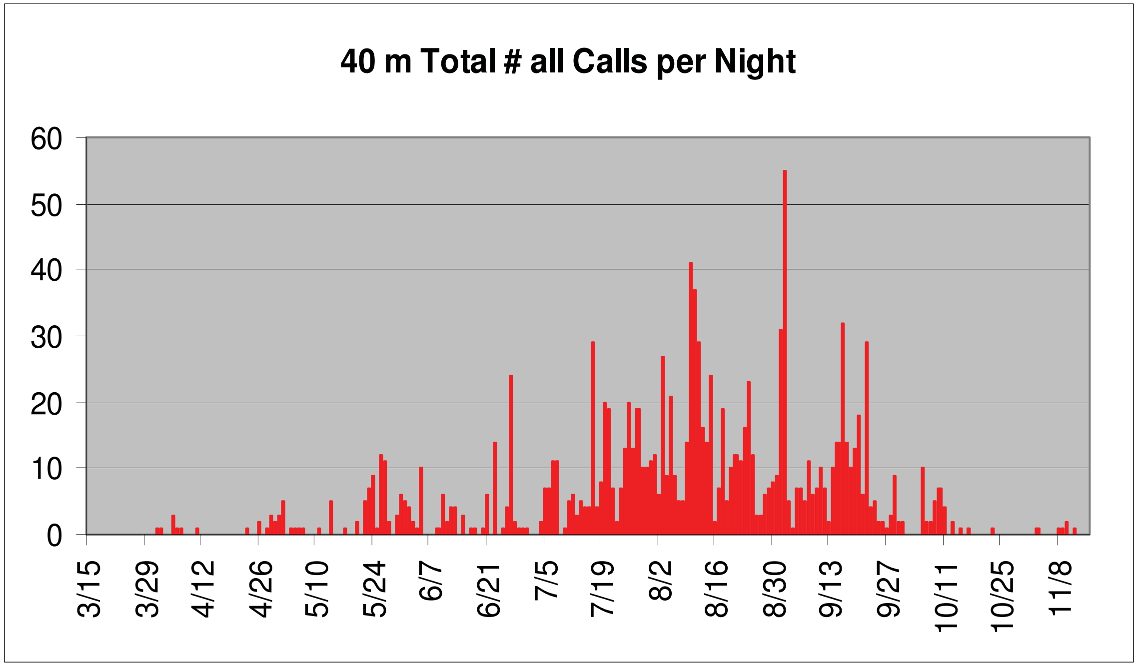


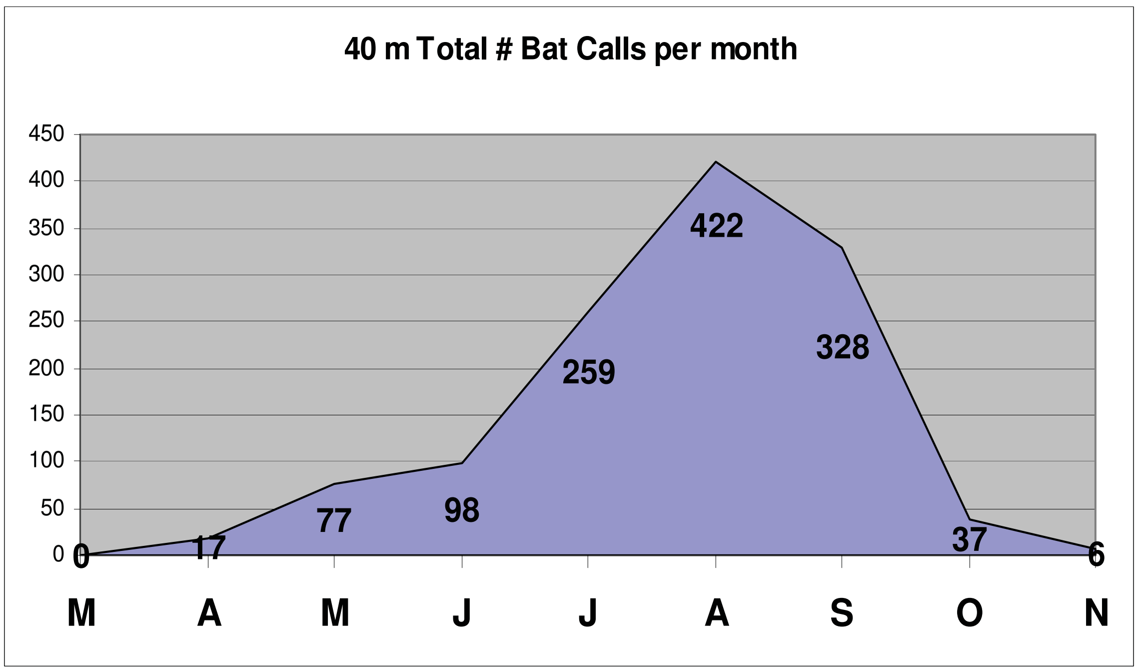

5m # Hoary Calls by date

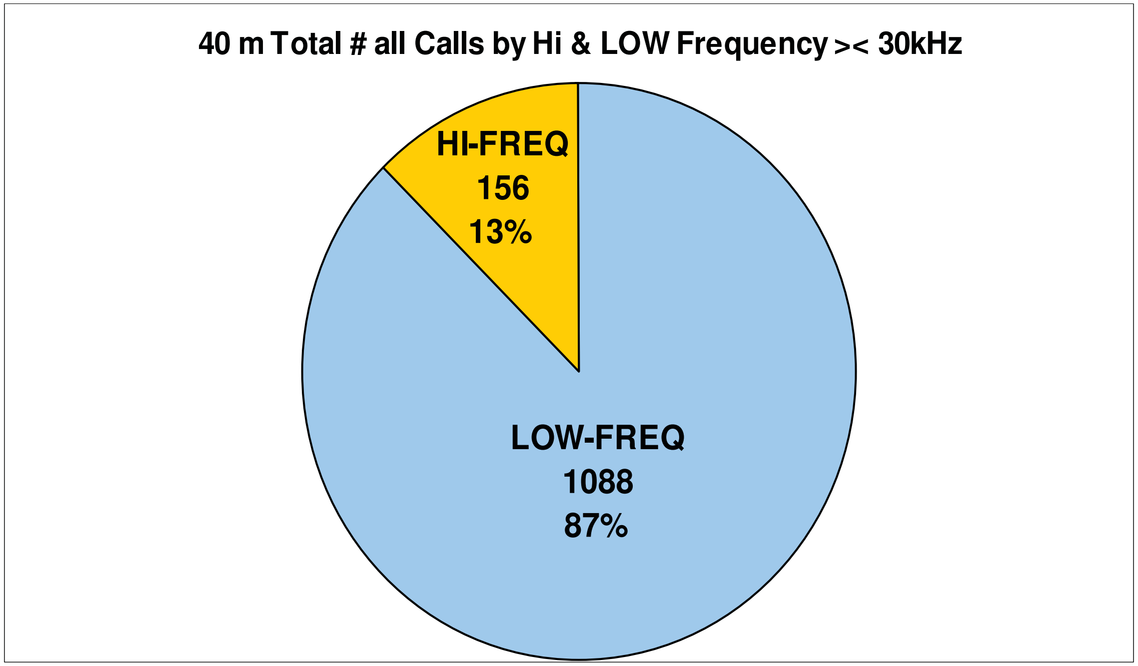


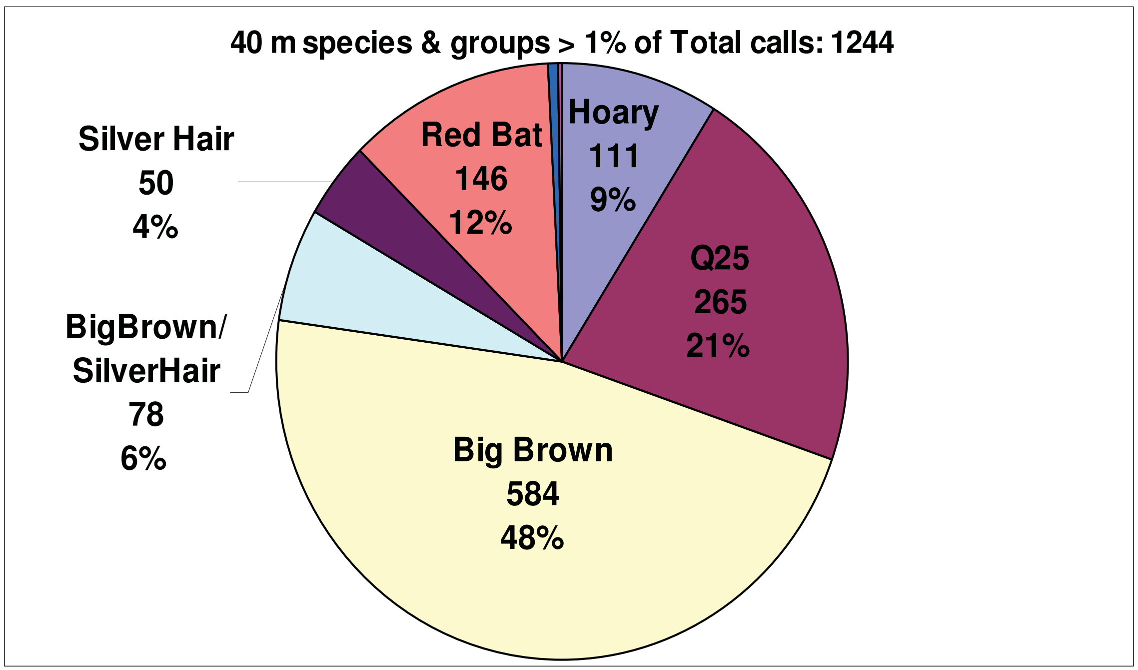

5m # Silver Haired Calls by date
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
5/6
5/20
6/3
6/17
7/1
7/15
7/29
8/12
8/26
9/9
9/23

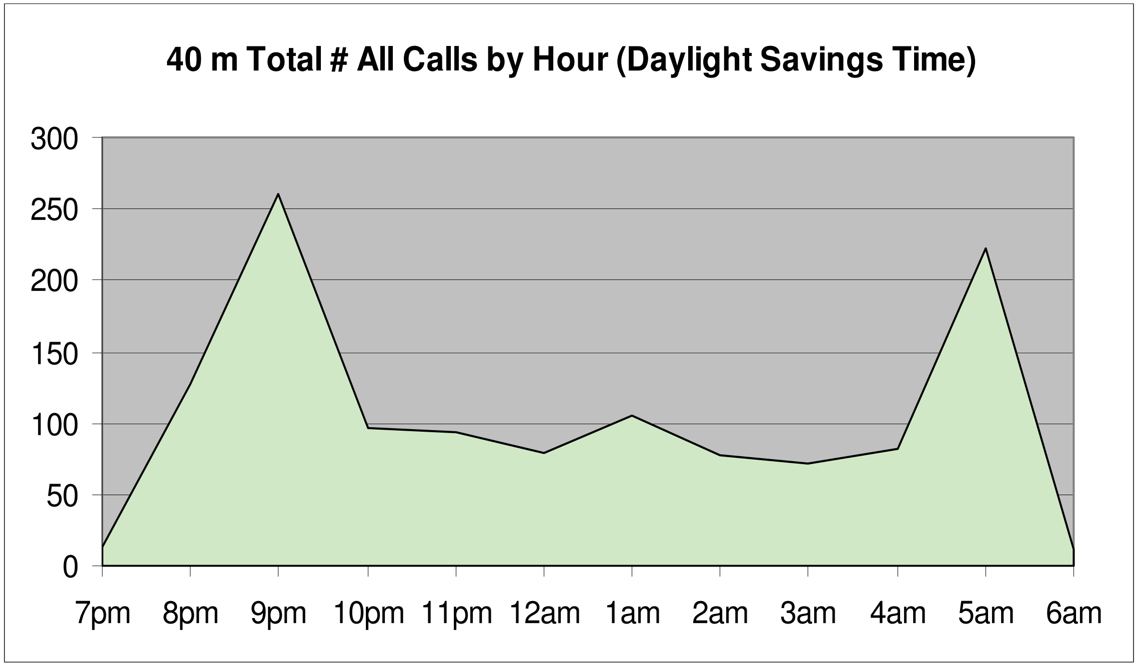

5m # Myotis Calls by date
2.5
2
1.5
1
0.5
0
5/29
6/5
6/12
6/19
6/26
7/3
7/10
7/17
7/24
7/31
8/7
8/14

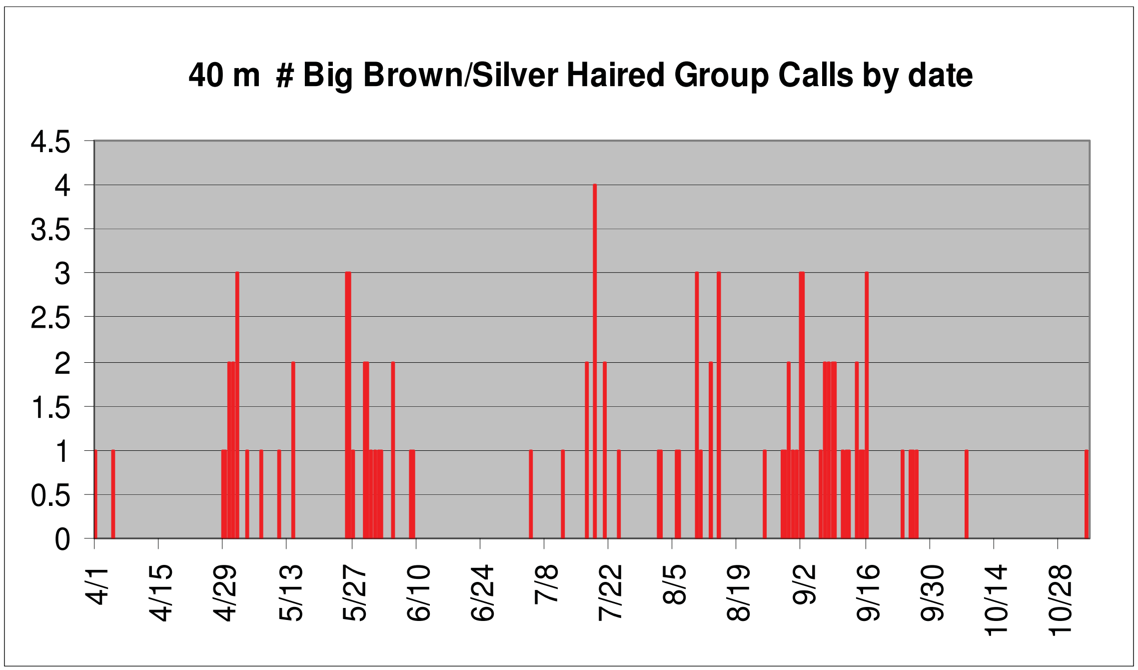

40 m Total # all Calls per Night
60
50
40
30
20
10
0
3/15
3/29
4/12
4/26
5/10
5/24
6/7
6/21
7/5
7/19
8/2
8/16
8/30
9/13
9/27
10/11
10/25
11/8

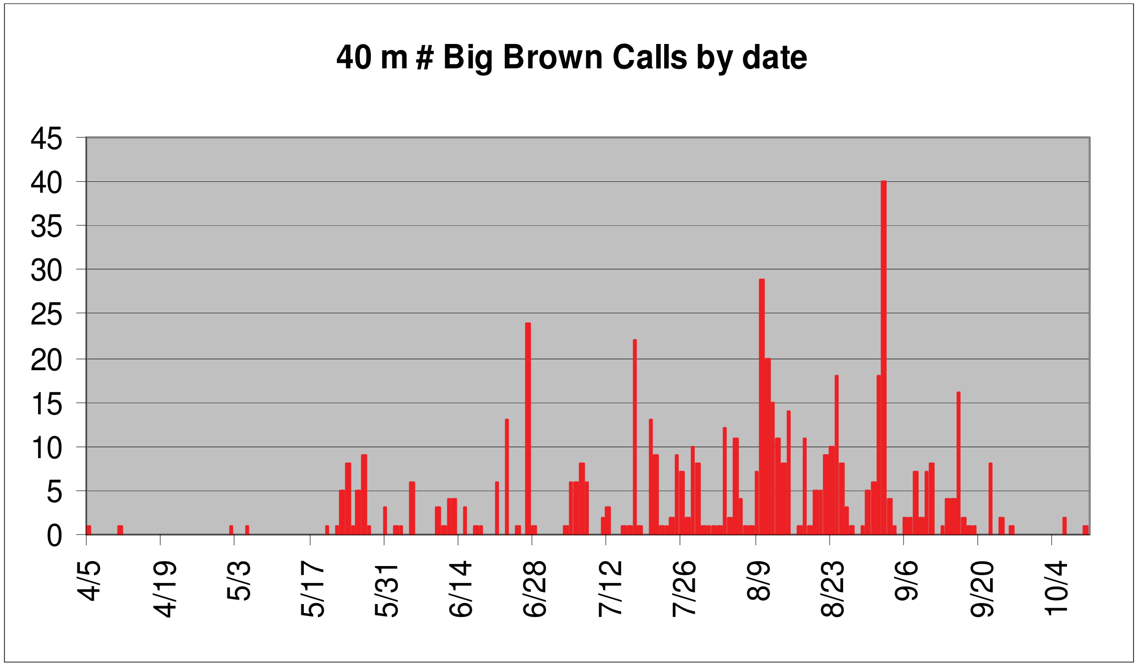

40 m Total # Bat Calls per month
450
400
350
300
250
200
150
100
50
0
0
17
77
98
259
422
328
37
6
M
A
M
J
J
A
S
O
N

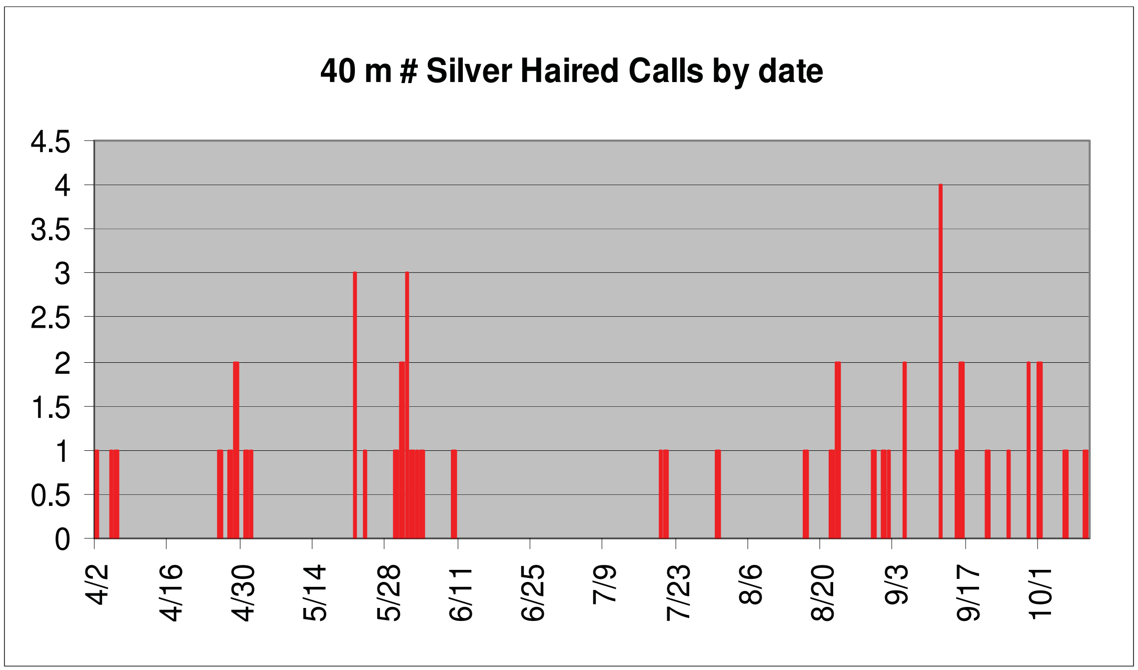

40 m Total # all Calls by Hi & LOW Frequency >< 30kHz
HI-FREQ
156
13%
LOW-FREQ
1088
87%

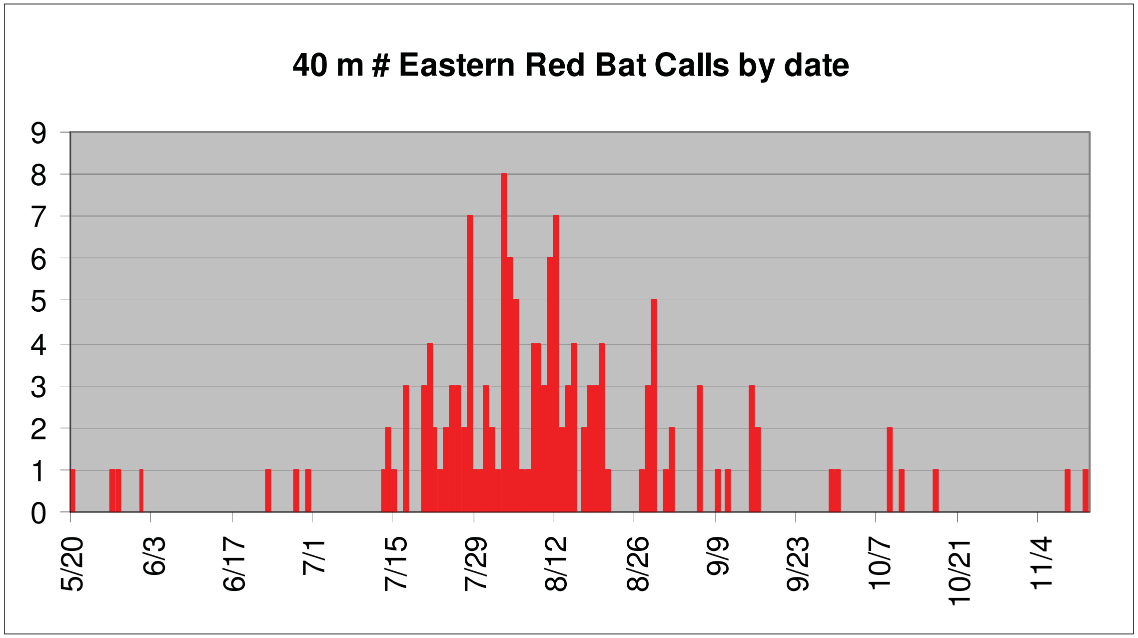

40 m species & groups > 1% of Total calls: 1244
Silver Hair
50
4%
Red Bat
146
12%
Hoary
111
9%
Q25
265
21%
BigBrown/
SilverHair
78
6%
Big Brown
584
48%

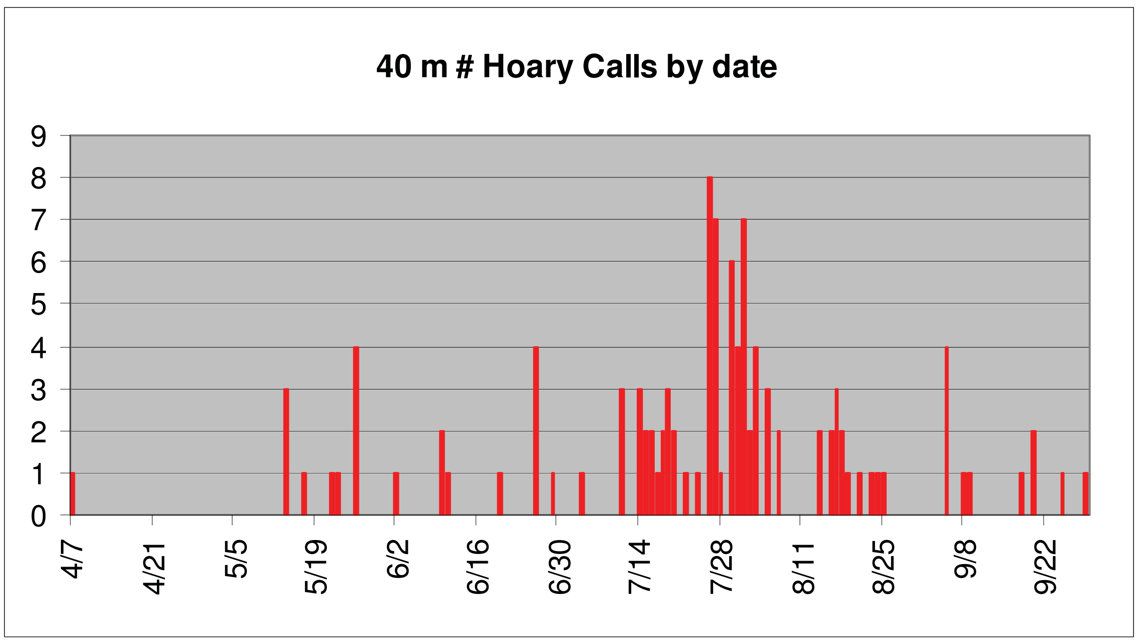

40 m Total # All Calls by Hour (Daylight Savings Time)
300
250
200
150
100
50
0
7pm
8pm
9pm
10pm
11pm
12am
1am
2am
3am
4am
5am
6am


40 m # Big Brown/Silver Haired Group Calls by date
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
4/1
4/15
4/29
5/13
5/27
6/10
6/24
7/8
7/22
8/5
8/19
9/2
9/16
9/30
10/14
10/28


40 m # Big Brown Calls by date
45
40
35
30
25
20
15
10
5
0
4/5
4/19
5/3
5/17
5/31
6/14
6/28
7/12
7/26
8/9
8/23
9/6
9/20
10/4


40 m # Silver Haired Calls by date
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
4/2
4/16
4/30
5/14
5/28
6/11
6/25
7/9
7/23
8/6
8/20
9/3
9/17
10/1


40 m # Eastern Red Bat Calls by date
0
1
2
3
4
5
6
7
8
9
5/20
6/3
6/17
7/1
7/15
7/29
8/12
8/26
9/9
9/23
10/7
10/21
11/4


40 m # Hoary Calls by date
0
1
2
3
4
5
6
7
8
9
4/7
4/21
5/5
5/19
6/2
6/16
6/30
7/14
7/28
8/11
8/25
9/8
9/22

# Appendix C – Example Sonogram

# Sonogram of hoary bat call viewed in AnalookW